INTERNATIONAL CONFERENCE OF AGRICULTURAL ECONOMISTS
ICAE
29th | Milan Italy 2015
UNIVERSITÀ DEGLI STUDI DI MILANO AUGUST 8 - 14
AGRICULTURE IN AN INTERCONNECTED WORLD

Kenyan Awareness of Aflatoxin: An Analysis of Processed Milk Consumers

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Abstract

Aflatoxin is a human health threat in many developing countries. This study examines Kenyan milk consumers' behaviour toward aflatoxin by way of choice experiments. Further, the willingness to pay for different types of milk and aflatoxin status awareness was assessed. Five attributes were selected to describe milk products: milk processing technique, fat content, packaging, price and aflatoxin-free certification.

Results indicate that awareness of aflatoxin is high, and that consumers are willing to pay a significant premium for milk that is certified as aflatoxin-free. Results also show, however, that the substantial majority does not know how to avoid aflatoxin-contaminated milk. The results indicate a great need for further education and awareness-raising programs throughout the Kenyan dairy value chain, and a potential for market-based solutions to aflatoxin control in milk.

1. Introduction

Aflatoxins are mycotoxins produced by certain species of moulds, mainly *Aspergillus flavus* and *Aspergillus parasiticus*. Aflatoxins are considered an important public health concern in the developing world and can seriously affect people's health and livelihoods. The problem is rooted throughout the food chain, and as freedom of choice in food is limited for a poor and food-insecure population, exposure to aflatoxin is widespread and consumers in developing countries are at risk from aflatoxin-related illnesses. Recent estimates suggest that there are more than five billion people worldwide at risk of chronic exposure to aflatoxins (Williams *et al.*, 2004; WHO, 2005).

Although there are no accurate estimates of incidence of chronic and acute disease related to aflatoxin exposure, outbreaks in Kenya (1982, 2001, 2004 and 2005) and Somalia (1997/98) indicate the magnitude of the problem. The 2004 outbreak in Kenya was responsible for 317 cases and 125 deaths. A known consequence of chronic exposure to aflatoxins is increased risk of liver cancer. Moreover, aflatoxin exposure in young children has been shown to be associated with stunting and underweight (Wang *et al.*, 1996; WHO, 2005). In general, adults have a higher tolerance for aflatoxin than children, and children are more prone to death from acute aflatoxicosis (Cullen and Newberne, 1994).

Because Kenya´s climate is favorable to the growth of aflatoxin-producing moulds, the country faces high risk of mycotoxin-related livestock and human poisoning (Lanyasunya *et al.*, 2005). Humans are exposed to aflatoxins not only through staple foods such as cereals, but also through animal source food; the most risky food is milk (Jarvis, 2002). Aflatoxins found in milk are produced by lactating animals after they have consumed aflatoxin-contaminated feed or fodder (Lanyasunya *et al.*, 2005; Lizárraga-Paulin, 2011). The most effective means of controlling aflatoxin in milk is therefore by restricting its presence in the cattle´s feed (FAO, 2005).

Feed represents the largest part of the cost of milk production in market-oriented Kenyan dairy farming, and so there is a pronounced incentive for minimizing these costs. There are consequent incentives to feed forage of low quality, and such practices are widely observed (Muriuki, 2011). There are no effective mechanisms to ensure quality in the market for feeds.

The negative impacts of aflatoxins in milk on human health have led to several research projects being focused on the subject. Widespread uptake of information on similar threats to

health in Kenya, from various sources, has been documented (USAID, 2010). The consequence should be a dairy industry encouraged to strive for better control of aflatoxins' occurrence in milk. Milk is an important source of animal protein in Kenya. It is of special importance for society's three most nutritionally vulnerable groups: infants, children and pregnant women. Therefore, if exposure could be reduced by inspection and certification controlling the levels of aflatoxins in milk, the overall health of Kenyans could be enhanced, while also reducing health care costs.

In Kenya, milk production is dominated by smallholders' dairy farmers who contribute more than 70 percent of gross marketed production. Besides smallholders, there are around 30 licensed milk processors. More than 80 percent of the total processed milk is handled by four largest processors combined. In addition, two of those are responsible for more than 60 percent of the total milk processing (MoLD, 2008). Standards must be realistic for this context, for setting up and administering certification. Introducing licensing of milk processors involves monitoring of milk quality not only at the end processing level but also at the production level. This implies additional production and handling costs that directly affect milk selling prices.

Understanding consumer behaviour plays a major role in the design of successful interventions in commercial processes. Relevant research has been widely conducted in developing countries for animal products' consumption (e.g. Jabbar *et al.*, 2010). The current study aims to reveal important insights in Kenyans´ milk purchase and consumption behaviour. It also addresses a major public health concern by focusing on aflatoxin. Kenyan processed milk consumers' perceptions of aflatoxin are identified, along with any willingness to pay (WTP) for an aflatoxin-free certificate. Such WTP could encourage dairy stakeholders to invest in credible certification instruments. This paper also identifies the needs of a certification by providing insights into milk consumers´ attitudes.

This paper is organized into four main sections. After this introduction, the second section is on the methodology followed and the process of data collection, followed by the results and discussion section, and finalized by the conclusions and main recommendations.

2. Methodology and data

2.1 Data collection

A survey was conducted during July 2013 using face-to-face interviews with consumers/buyers of processed milk. The survey was conducted in different urban areas of Nairobi characterized by mainly middle-income inhabitants such as Buru-Buru, Nairobi West and South C. Besides, customers of Sarit Centre which is one of the largest shopping malls of Eastern Africa were interviewed.

For the selection of respondents, systematic sampling was conducted, pursuant to assumptions of randomness over time. Refusal to participate (an early concern of the authors) was negligible, so systematic bias concerning respondents´ characteristics is unlikely. All categories of consumers were targeted, by way of conducting the survey across different periods of time. This involved collection from Tuesday until Saturday from 9am to 6pm for a 3-week period. Four enumerators established a total sample size of 299 respondents.

The questionnaire contains five sections. The first addresses milk purchase and consumption habits, and so helps depict the respondent´s purchase and consumption behaviour. The second part assesses the respondent´s aflatoxin awareness. Following this, the consumer was given informational text informing about aflatoxins and the risks of aflatoxins in milk especially. This information was needed to complete the subsequent section of the questionnaire which simulates a purchase decision by using a choice experiment. Finally, some questions concerning the respondent´s attitudes and socio-demographic characteristics were asked.

To choose the appropriate attributes and their corresponding levels for the choice experiment, relevant literature about raw milk purchase and consumption in developed and developing countries (Waithaka *et al.*, 2002; Omore *et al.*, 2005; Makokha and Fadiga, 2010; Wolf et al., 2011; Fadiga and Makokha, 2014) was reviewed. To reflect the milk market´s price level, four levels ranging from 70 KSH to 130 KSH per litre were selected (Table 1).

<< Insert Table 1 >>

The combination of the five attributes with their corresponding levels led to a total of 144 (2x3x2x3x4) hypothetical products. As the questionnaire was supposed to be completed in a reasonable time, the number of choice cards needed to be reduced, and this task employed an orthogonal design procedure. Considering efficiency and orthogonality

requirements, without reducing variability, eight choice cards was the minimum feasible number. Each card contained three choices of hypothetical milk products. Respondents were asked to state their most, as well as their least, preferred choice of milk (product) for each card. The resulting choice experiment fulfils the properties of orthogonality, and exhibits a high D-efficiency level (95%). Figure 1 shows an example of a choice experiment card. This type of experiment is better known as a Best-Worst, or sometimes a Most-Least, experiment.

<< Insert Figure 1 >>

Respondents were asked to indicate the most and least preferred products. In the case of this experiment which includes three alternatives, the choice of most and least preferred products makes possible the full classification of the three products. Because the alternatives have no specific label or name, this class of choice experiment is referred to as generic or unlabelled (Louviere *et al.*, 2000).

2.2 Methodology

Conjoint analysis arises from the theory of Lancaster (1966), which stipulates that utility is derived from the properties or characteristics that goods possess (bundle of attributes) rather than the good *per se*. Since its first development during the 1970s (Green and Rao, 1971; Green and Srinivasan, 1978), the conjoint analysis technique has grown in popularity and has been extended to many disciplines such as transportation, telecommunications, the environment, marketing, and human health. In the agrifood sector, various studies used conjoint analysis (choice experiments) to explore consumer behaviour.

Choice experiment derives from the Lancaster assumption regarding overall utility decomposition as well as random utility theory (Manski, 1977). The latter states that overall utility U_{ij} can be expressed as the sum of a systematic (deterministic) component V_{ij}, which is expressed as a function of the attributes presented (raw milk characteristics in this example), and a random stochastic component ε_{ij}:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad \text{(Equation 1)}$$

Lancaster theory leads to the following linear additive decomposition of V_{ij}:

$$V_{ij} = \beta_1 x_{ij1} + \beta_2 x_{ij2} + \ldots + \beta_n x_{ijn} \quad \text{(Equation 2)}$$

where x_{ijn} is the n^{th} attribute value for card j for consumer i, and β_n represents the coefficients to be estimated. Finally, following additional assumptions about the distribution of the error term, the following probability models could be derived:

Conditional logit (CL) (McFadden, 1973):

$$\Pr(j) = \frac{e^{V_{ij}}}{\sum_{k \in C_n} e^{V_{ik}}} \quad \text{(Equation 3)}$$

Random parameters logit (RPL) model (Train, 2009):

$$\Pr(i) = \int \left(\frac{e^{\beta' . x_{ni}}}{\sum_j e^{\beta' . x_{nj}}}\right) . f(\beta) . d\beta \quad \text{(Equation 4)}$$

where $f(\beta)$ is the density function of β

Based on the aforementioned models, the willingness to pay (for specific attributes) (WTP) estimates are obtained as follows (Haefele and Loomis, 2001):

$$WTP_i = -\frac{\beta_i}{\beta_{price}} \quad \text{(Equation 5)}$$

In the case of the RPL model, a normal distribution for the random parameters is imposed.

3. Results and discussion

3.1 Milk purchase and consumption habits

The following paragraphs present the descriptive statistics for the study. As per sampling strategy, every respondent is consuming or buying raw milk, and all are Kenyan citizens.

Respondents were asked about their milk purchase habits (Table 2). For almost every respondent, processed milk is the first choice. Around nine percent consider raw milk as second choice. Cow milk is consumed by all respondents while other types of milk, such as goat and camel milk, play a negligible role.

<< Insert Table 2 >>

Women are more responsible for the household´s milk purchase than are men. The preferred purchase places of processed milk consumers in middle income areas of Nairobi are super-/hypermarkets as well as shops (Table 2). Kiosks, milk bars, and hawkers only play a minor role as purchase places. More than half of the respondents buy milk once a day, and 14

percent more than once a day. These numbers reflect the consumers´ concerns about freshness and quality concerning dairy products.

Three quarter of the respondents report knowing who has produced the milk they are buying and were asked how much they trust the producer to provide hygienically produced milk. The majority of respondents (90 percent) fully or mostly trust; only three percent do not trust at all.

The amounts of milk bought per purchase vary from 0.3 litres until more than 2.5 litres. Due to the common packaging sizes, the most popular amount bought is half a litre and one litre. The prices per litre primarily ranged between 80 KSH, 90 KSH and 100 KSH. Ten percent did not remember the amount of milk and even 16 percent did not know the price of the milk they recently purchased. The prices given by the respondents display the medium price level of the choice experiment which ranges between 70 KSH and 130 KSH.

Survey results for consumption habits are presented in Table 3. A high proportion of respondents report boiling milk prior to consumption and the majority of them believe milk is totally safe after boiling. The main reasons stated for boiling the milk (multiple answers allowed) were health and hygienic concerns, followed by the preference of warming the milk up and by "because everybody does it".

<< Insert Table 3 >>

Almost half of the respondents drink milk on a daily basis where the quantities of 250ml, 300ml and 500ml are the most frequent ones. In general, the quantities consumed vary from small amounts used in tea to amounts of half a litre. Half of the respondents consume milk every day, whereas this proportion of is slightly higher in the case of children (from three to 18 years of age), and much higher in the case of infants (two years and younger). On the other hand, 13 percent of households´ infants never consume milk (Table 3).

3.2 Consumers' aflatoxin awareness and opinions on certificates

Table 4 summarizes some of the findings of the aflatoxin awareness testing. These show that eighty percent of processed milk consumers have already heard about aflatoxins. In addition, the vast majority (72 percent) of those who had never heard about aflatoxin indicate that they do not know whether it can be transferred into milk. Without distinguishing between those who have heard or not have heard about aflatoxin, almost half of the 299 respondents

believe that aflatoxins in feed can be transferred into the milk. These respondents were asked further questions concerning aflatoxins in milk.

<< Insert Table 4 >>

Respondents further assessed the health impact on humans when consuming aflatoxin contaminated milk. The majority perceive a serious or medium threat. They were also asked if it is possible to make aflatoxin contaminated milk safe for human consumption. There is no substantial difference in the answers given, between persons that knew about aflatoxin before, and those that did not. In total, 23 percent assume that it is, 29 percent think it is not, and 48 percent do not know if it is possible to make the contaminated milk safe. Respondents who indicated that they believe it is possible to make aflatoxin contaminated milk safe for human consumption were also asked how this can be done (an open-ended question). The majority answered boiling the milk, although in fact boiling the milk will not help to make aflatoxin contaminated milk safe. Also using new technologies or/and chemicals and controlling/testing of milk or/and feed was an often stated answer by processed milk consumers. Only few people said that not feeding contaminated feed ensures safe milk, although this is, according to FAO (2005), the most effective means of controlling aflatoxins in milk.

In addition to assessing the WTP for aflatoxin-free certified milk, it is important to know consumers´ attitude towards information provided by the industry or government, such as labels and certificates which would be the main communicated elements of the certification system. The survey sought respondents´ opinions about food certificates/food safety labels, as well as information given on product packaging labels and commercial advertisements. Results are similar for both of these as indicated in Table 5. However, the perception of certificates and labels is slightly more positive than that of packaging and advertisements. Around 40 percent fully or mostly trust in food certificates and labels; the same percentage does not. Another 16 percent do not even look at those. Concerning packaging labels and advertisements, around 30 percent have a rather positive attitude, more than 40 percent are negatively-minded and some 28 percent do not even look at them.

<< Insert Table 5 >>

The survey also assessed milk consumers´ main sources of information for staying current. Multiple answers were allowed and the results are consistent with those achieved by

USAID in 2010. Television is the most popular one, and it's followed by internet, radio and newspaper. Consequently, TV and internet are the most efficient channels to inform people in urban areas. As outlined above, these communication means are available to organizations in order to spread information, for example about health threats and new products.

3.3 Models' estimates and consumers' willingness to pay

3.3.1. Models' estimates

As discussed, we used two models (CL and RPL) to analyse the importance of raw milk attributes and evaluate consumers' willingness to pay (WTP) for processed milk attributes. The log likelihood ratio test (LL) indicates the two models´ overall significance. The obtained results (Table 6) for both models feature almost the same coefficients´ signs and pattern of significance. The majority of the variables are significant at a 1% or 5% level of test, in each model.

<< Insert Table 6 >>

Results from Table 6 indicate that consumers prefer pasteurized to UHT milk. In the case of RPL model the coefficient is not statistically significant although heterogeneity of consumers' perception is depicted by the highly significant standard deviation of the random parameter coefficient (SD_UHT). We performed a likelihood ratio test to test the null hypothesis that the conditional logit fits the data better than the random parameters logit. Result indicates the rejection of the null hypothesis (likelihood ratio = 858.8 > $\chi^2_{(7;\,1\%)} = 18.48$). Thus the RPL model is preferred to the CL model. All the coefficients of the standard deviation of the random parameters are statistically significant at 1% level, which indicates heterogeneous preferences among processed milk consumers.

The RPL model estimates indicate that consumers prefer milk with higher fat content: whole milk is preferred to low fat milk which is preferred to skimmed milk. As expected, aflatoxin-free certified milk is preferred to non-certified one. The negative price coefficient estimate indicates that lower prices are preferred to higher prices, which is consistent with conventional demand theory. Consumers prefer TetraPak packaged milk in comparison to plastic container and pouch.

From the estimated means and standard deviations of the coefficients, it is possible to assess the share of the respondent that place a positive or negative value on the attribute trait

(Ouma et al., 2007). Certified aflatoxin-free milk is preferred by 93% of the respondents, which indicates that the majority of the population prefers a certified product. The consensus is lower when it comes to whole milk preference where only 55% of the population shows a positive preference for this trait. The proportion is much lower for the skimmed characteristic, where only 36% of the population shows a positive preference for the attribute.

3.3.2. Consumers' willingness to pay

The second step in the analysis was to estimate consumers' willingness to pay (WTP) following equation 5. Table 7 summarizes the WTP estimates and 95% confidence intervals obtained following the Krinsky and Robb (1986) parametric bootstrapping procedure with 2,000 replications. The WTP estimates obtained with CL and RPL differ. This was expected since for the latter model, consumers' preference heterogeneity is taken into account.

<< Insert Table 7 >>

Although the great majority of respondents stated that they fully or mostly trust in the hygienic milk handling of milk producers, results indicate that they would be willing to pay a premium for improved quality. Especially for an aflatoxin-free certificate, Kenyan processed milk consumers would be willing to pay a high premium. Both CL and ROL show a WTP between 121 and 137 KSH.

On average, consumers would pay a premium of 7 KSH to avoid fat reduced milk and to get whole milk. The negative sign of the skimmed milk´s WTP shows the disapprobation of that kind of milk. Such results indicate that even middle-income groups consider milk as a nutrient rather than a drink. On the other hand, it might be that taste attributes are more important than health attributes are. Moreover, it is likely that people are prejudiced concerning fat-reduced products as they assume they lack in taste, flavour and nutrients.

However, as important whole milk is for the undernourished population, as important it is to educate urban Kenyans about advantages of fat-reduced milk products since obesity is becoming a severe problem among that society (Ziraba *et al.*, 2009; Steyn *et al.*, 2011).

The premium people are willing to pay for milk in tetra pack compared to milk in pouch plastic bag is around 18 KSH. Also plastic bottles are favoured which is expressed by the WTP of around 10 KSH.

3.3.3. Consumers' segmentation and their willingness to pay for a certified product

As presented earlier in the paper, consumers have been asked if they have already heard about aflatoxin, and if they think that the toxins (aflatoxins) in mouldy feed given to a dairy cow could be transferred into the milk it produces. From these two questions, respondents were segmented into 2 groups (for each case) and their WTP for aflatoxin certified product was assessed using a random parameters logit model. Table 8 presents the results for each group.

<< Insert Table 8 >>

The results indicate that milk consumers who have heard about aflatoxin are willing to pay on average around 162 KSH/l for certified aflatoxin-free milk. This amount is higher compared to the 99 KSH/l that non-aware respondents are willing to pay (64% increase). Milk consumers who stated that aflatoxin can be transferred into milk through cows fed with mouldy feed are willing to pay on average a premium of 165 KSH/l for a certified product. Respondents who don't think or don't know if aflatoxin can be transferred into milk are willing to pay less money (around 130 KSH/l).

These results indicate that consumers' awareness about aflatoxin increases their WTP for a certified product. In other terms, an awareness and sensitisation campaign undertaken by the milk board will have positive impacts on consumers' willingness to pay for an aflatoxin-free certified product.

4. Conclusion and implications

This study reveals important insights into Kenyans´ attitudes and behaviour regarding milk and its consumption.

The results show that consumers in urban areas are willing to pay a premium for buying an aflatoxin-free certified milk. Urban milk consumers generally belong to the medium or high income class. An increase in processed and aflatoxin-free certified milk price will probably not affect consumers' demand for the product (16% of respondents declared they don't remember the price of the milk bought). USAID (2010) research found that quality improvements are desired by a high percentage of milk consumers, and that an aflatoxin-free certificate would be in demand.

The survey revealed that a high proportion of Kenyans does not trust certificates and labels. As this result contradicts some other findings in similar contexts (Jabbar et al., 2010), the need for further research is apparent, possibly on steps to improve the image of Kenyan certification. Certification requires credibility and intense public information, as well as institutional development. Although the current study does not address these issues directly, its findings of significant WTP suggest that there is sufficient private incentive for change to occur. Hence, its results can be used to put further pressure on stakeholders in the milk value chain to tackle the challenging objective of establishing an independent certification setup that will be accepted and trusted.

As processors are aware that milk of high quality leads to increased sales (USAID, 2010), there can be expected to be interest in enhancing their products by certifying them. Launching a certificate involves cost which would be incident to some extent on milk consumers. Therefore, people need to understand why there is a need to pay more for milk. The study shows that people do not have sufficient knowledge about aflatoxin and its associated health risks in milk. Research results such as these can then provide the latest and most relevant information which, in association with dairy industry advertisements and brands, can have a high impact on Kenyans and their perceptions. This advocates for partnership amongst researchers, government and the private sector, for further research into the topics covered here, and for further examination of experimental methods and analytical approaches.

Acknowledgement

This article is part of the FoodAfrica Programme, financed as research collaboration between the MFA of Finland, MTT Agrifood Research Finland, the CGIAR research programs on: Agriculture for Nutrition and Health and on Policies Institutions Markets led by the International Food Policy Research Institute, and the GIZ.

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Table 1. Selected packaged milk attributes and their corresponding levels

Attributes	Levels
Milk processing	Pasteurized
	UHT
Milk fat content	Whole
	Low fat
	Skimmed
Aflatoxin-free certified milk	Certified
	Non-certified
Milk packaging	Plastic container
	Tetra Pak
	Pouch
Milk price	70 KSH/Litre
	90 KSH/Litre
	110 KSH/Litre
	130 KSH/Litre

Table 2. Selected milk purchase sample habits

Characteristic	Definition	%
Milk bought/purchase occasion	0.3 litre	1
	0.5 litre	57
	1.0 litre	20
	2.0 litres and more	12
	I don´t remember	10
Price per litre	80 KSH /litre	20
	90 KSH /litre	43
	100 KSH /litre	11
	Other	10
	I don´t remember	16
Place of purchase	Super-/Hypermarket	77
(Multiple answers)	Shop	65
	Kiosk	6
	Milk Bar	1
	Hawker	1
Frequency of milk purchase	More than once a day	14
	Once a day	55
	Several times per week	20
	Once a week	7
	Occasionally	4

Table 3. Selected milk consumption habits

Characteristic	Definition	%
Boiling milk prior to consumption	Yes	79
	No	21
Milk is safe after boiling	Yes	93
	No	7
Reasons for boiling the milk	Health concerns	53
(Multiple answers)	Hygienic concerns	34
	No refrigeration	3
	Uncertainty about milk´s freshness	8
	Because everybody is doing it	10
	To warm the milk up	14
Personal consumption frequency	Daily	48
	Several times per week	8
	Occasionally	31
	Never	13
Own infants´ consumption frequency	Daily	65
	Occasionally	3
	Never	13
	I don´t know	19
Own children´s consumption frequency	Daily	58
	Occasionally	13
	Never	7
	I don´t know	22

Table 4. Selected aflatoxin awareness sample findings

Characteristic	Definition	%
Heard about aflatoxin	Yes	80
	No	20
Aflatoxins can be transferred into milk	Yes	45
	No	9
	I don´t know	46
People who have heard about aflatoxin	Aflatoxin can be transferred	51
	Aflatoxin cannot be transferred	9
	I don´t know if Aflatoxin can be transferred	40
People who have not heard about aflatoxin	Aflatoxin can be transferred	18
	Aflatoxin cannot be transferred	10
	I don´t know if aflatoxin can be transferred	72
Health impact on humans	Serious threat	71
	Medium threat	16
	Minor threat	1
	No threat at all	2
	I don´t know	10
Possible to make aflatoxin contaminated milk safe	Yes	23
	No	29
	I don´t know	48
Options to make aflatoxin contaminated milk safe (Multiple answers)	Boiling	62
	Use of new technologies or/and chemicals	31
	Controlling/testing of milk or/and feed	14

Table 5. Opinions on certificates, labels and advertisements

Characteristic	Definition	%
Opinion of food certificates/ food safety labels	Fully trust	19
	Mostly trust	24
	Do not really trust	22
	Do not trust at all	19
	Do not even look at them	16
Opinion of packaging labels / advertisements	Fully rely	13
	Mostly rely	18
	Do not really rely	27
	Do not rely at all	14
	Do not even look at them	28

Table 6. Estimated CL and RPL models' coefficients

Variable	CL		RPL	
	Coefficient	Standard deviation	Coefficient	Standard deviation
UHT[a]	-0.1166**	0.0583	0.0319	0.1226
Whole[b]	0.1513**	0.0648	0.3077*	0.1807
Skimmed[c]	-0.1634**	0.0731	-0.4711***	0.1666
Certified[d]	1.8736***	0.0691	6.2639***	0.5559
Plastic[e]	0.2564***	0.0760	0.42736***	0.1434
TetraPak[f]	0.2782***	0.0643	0.8408***	0.1272
Price	-0.0155***	0.0013	-0.0458***	0.0059
SD_UHT			-0.8260***	0.1755
SD_Whole			2.2844***	0.2269
SD_Skimmed			1.2963***	0.1839
SD_Certified			4.2813***	0.4018
SD_Plastic			-0.5028**	0.2510
SD_TetraPak			-0.5693***	0.1719
SD_Price			0.0735***	0.0071
LL	-1803.4***		-1374.0***	
Pseudo R^2	0.3137			

[a] Dummy variable takes 1 when milk is UHT and 0 when it is pasteurized.

[b] Dummy variable takes 1 when it is whole milk and 0 when it is low fat or skimmed.

[c] Dummy variable takes 1 when it is skimmed milk and 0 when it is whole or low fat.

[d] Dummy variable takes 1 when milk is certified and 0 when it is not certified.

[e] Dummy variable takes 1 when milk is sold in plastic container , 0 when it is a tetra pack or pouch.

[f] Dummy variable takes 1 when milk is sold in tetra pack, 0 when it is a plastic container or pouch.

***Significant at 1%, **Significant at 5%, *Significant at 1%.

Table 7. Willingness to pay (WTP) estimates and 95% confidence intervals (CI)

Variable	CL		RPL	
	WTP (KSH/l)	95% CI	WTP (KSH/l)	95% CI
UHT	-7.5	[-15.5; -0.4]	0.7	[-4.56; 5.8]
Whole	9.7	[1.3; 19.1]	6.7	[-1.1; 15.4]
Skimmed	-10.5	[-19.0; -1.0]	-10.3	[-17.7; -3.1]
Certified	120.7	[102.5; 144.1]	136.8	[108.7; 176.3]
Plastic	16.5	[6.7; 26.4]	9.3	[3.1; 16.3]
TetraPak	17.9	[10.0; 26.7]	18.4	[12.8; 25.8]

Table 8. WTP estimates and 95% confidence intervals (CI) for "aflatoxin free" certified milk

Segment	WTP (KSH/l)	95% CI
All sample	136.8	[108.7; 176.3]
Heard about aflatoxin	161.7	[121.4; 226.4]
Have not heard about aflatoxin	99.0	[68.0; 154.1]
Aflatoxin can be transferred	165.2	[111.0; 259.2]
It can't be transferred /don't know	129.7	[95.7; 179.3]

Figure 1. An example of a choice experiment card

Card 1

Please indicate the most preferred cow milk and the least preferred cow milk (Tick only one case in each line)

	Milk 1	**Milk 2**	**Milk 3**
	Pasteurized	Pasteurized	UHT
	Whole	Skimmed	Low Fat
	Aflatoxin-free certified	Non-certified	Aflatoxin-free certified
	Tetra pack	Plastic container	Pouch
	90 KSH/Litre	130 KSH/Litre	110 KSH/Litre
Most preferred	☐	☐	☐
Least preferred	☐	☐	☐